

**WHAT WE CLAIM IN THE INVENTION IS:**

- 1           1.     A method of forming an interconnect structure of a semiconductor  
2 device, the interconnect structure having a dielectric material deposited over an  
3 underlying interconnect layer and having a via extending through the dielectric  
4 material for establishing a connection between an underlying conductor and a  
5 trench in an upper portion of the dielectric material, comprising the steps of:  
6               (a)     forming a mask layer over the dielectric material;  
7               (b)     forming a via in the mask layer to a first predetermined depth  
8 of the mask layer;  
9               (c)     forming a trench in the mask layer to a second  
10 predetermined depth of the mask layer, which is not as deep as said first  
11 predetermined depth of the via formed in the mask layer;  
12               (d)     forming a via through the dielectric material to the underlying  
13 conductor, corresponding to the dimensions of the via formed in the mask layer;  
14 and,  
15               (e)     forming a trench in the dielectric material to a predetermined  
16 depth of the dielectric material corresponding to the dimensions of the trench  
17 formed in the mask layer.
- 1           2.     The method of claim 1 further including the step of removing a  
2 predetermined amount of the mask layer from the semiconductor device and  
3 leaving a film of the mask layer thereon over the dielectric material.
- 1           3.     The method of claim 1 wherein said dielectric material includes a  
2 via dielectric layer formed over the interconnect layer, a barrier layer disposed  
3 between the via dielectric layer and the interconnect layer, a trench dielectric  
4 layer formed over the via dielectric layer, and an etch stop layer disposed  
5 between the trench dielectric layer and the via dielectric layer.

1           4.     The method of claim 3 wherein said step of etching the via includes  
2 etching the via through the via dielectric layer and the barrier layer, and the step  
3 of etching the trench includes etching the trench through the trench dielectric  
4 layer.

1           5.     The method of claim 4 further including the step of removing a  
2 predetermined amount of the mask layer from the semiconductor device and  
3 leaving a film of the mask layer thereon over the dielectric material.

1           6.     A method of forming an interconnect structure using a mask layer  
2 deposited over a dielectric material which has been deposited over an underlying  
3 interconnect layer, comprising the steps of:

4               (a)   forming a first mask film over the dielectric material having a  
5 known set of etch properties;

6               (b)   forming a second mask film over the first mask film having a  
7 known set of etch properties different from the etch properties of the first mask  
8 film;

9               (c)   forming a third mask film over the second mask film having  
10 etch properties substantially identical to the etch properties of the first film; and,

11              (d)   forming a fourth mask film over the third mask film having  
12 etch properties substantially identical to the etch properties to the etch properties  
13 of the second mask film; and

14              (e)   selectively etching the mask films in multiple steps to form  
15 the interconnect structure.

1           7.     The method of claim 6 further including the steps of forming a via  
2 through the dielectric material to the underlying interconnect layer and forming a  
3 trench within the dielectric material, to a predetermined depth of the dielectric  
4 material.

1           8.     The method of claim 6 further including the steps of forming the via  
2     in the mask layer down to the first mask film and forming the trench in the mask  
3     layer down to the third mask film.

1           9.     The method of claim 8 further including the steps of forming the via  
2     through the dielectric material and forming the trench to a predetermined depth of  
3     the dielectric material.

1           10.    The method of claim 8 further including the steps of forming a via  
2     through the dielectric material, forming a trench in the mask layer down to the  
3     first mask layer and forming a trench in the dielectric material to a predetermined  
4     depth of the dielectric material.

1           11.    The method of claim 10 further including the step of removing the  
2     third and fourth mask films from the semiconductor device.

1           12.    The method of claim 10 further including the step of removing the  
2     second mask film, the third mask film and the fourth mask film from the  
3     semiconductor device.

1           13.    The method of claim 8 further including the steps of forming a via  
2     dielectric layer over the underlying interconnect layer, forming a trench dielectric  
3     layer over the via dielectric layer, forming an etch stop layer between the via  
4     dielectric layer and trench dielectric layer.

1           14.    The method of claim 13 the steps of simultaneously forming the via  
2     through the etch stop layer and etching the fourth mask film from the  
3     semiconductor device.

1           15.    The method of claim 8 further including the steps forming a barrier  
2     layer between the via dielectric layer and the interconnect layer.

1           16.    The method of claim 15 the steps of simultaneously forming the via  
2 through the barrier layer and removing the third mask film from the  
3 semiconductor device.

1           17.    The method of claim 16 further including the steps of forming the  
2 trench through the trench dielectric layer, and simultaneously removing the etch  
3 stop layer exposed within the trench and the second mask film.

1           18.    A method of forming an interconnect structure using a mask layer  
2 deposited over a dielectric material which has been deposited over an underlying  
3 interconnect layer, comprising the steps of:

4                   (a)    forming a via dielectric layer over the underlying interconnect  
5 layer,

6                   (b)    forming a trench dielectric layer over the via dielectric layer,

7                   (c)    forming an etch stop layer between the via dielectric layer  
8 and trench dielectric layer;

9                   (d)    forming a barrier layer between the via dielectric layer and  
10 the interconnect layer;

11                   (e)    forming a first mask film over the dielectric material having a  
12 known set of etch properties;

13                   (f)    forming a second mask film over the first mask film having a  
14 known set of etch properties different from the etch properties of the first mask  
15 film;

16                   (g)    forming a third mask film over the second mask film having  
17 etch properties substantially identical to the etch properties of the first film; and

18                   (h)    forming a fourth mask film over the third mask film having  
19 etch properties substantially identical to the etch properties to the etch properties  
20 of the second mask film.

1           19.    The method of claim 18 further including the steps of forming a via  
2 in the mask layer down to the first mask film and forming a trench in the mask  
3 layer down to the third mask film, and the trench overlapping the via.

1           20.    The method of claim 19 further including the steps of forming a via  
2 through the dielectric layer and the barrier layer corresponding to the dimensions  
3 of the via formed in the mask layer, forming a trench through the trench dielectric  
4 layer corresponding to the dimensions of the trench formed in the mask layer,  
5 and said trench in the trench dielectric overlapping the via in the via dielectric  
6 layer.

1           21.    The method of claim 20 further including the step of removing the  
2 fourth mask film and the third mask film from the semiconductor device.

1           22.    The method of claim 21 further including the step of removing the  
2 second mask film.

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